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A COMPARATIVE STUDY BETWEEN SINGLE DOSE INTRALESIONAL AUTOLOGOUS BLOOD AND CORTICOSTEROID INJECTION IN CHRONIC PLANTAR FASCIITIS-A short term follow-up study

DISSERTATION SUBMITTED FOR

MS DEGREE (BRANCH II - ORTHOPAEDIC SURGERY)

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CERTIFICATE

This is to certify that the dissertation entitled **"A COMPARATIVE STUDY BETWEEN SINGLE DOSE INTRALESIONAL AUTOLOGOUS BLOOD AND CORTICOSTEROID INJECTION IN CHRONIC PLANTAR FASCIITIS-A short term follow-up study"** is a bonafide record of work done by ***Dr. S.ARUN*** in the Department of Orthopaedics, Coimbatore medical college hospital,coimbatore, under the direct guidance of me.

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DECLARATION

I **Dr. S.ARUN,** solemnly declare that the dissertation entitled "**A COMPARATIVE STUDY BETWEEN SINGLE DOSE INTRALESIONAL AUTOLOGOUS BLOOD AND CORTICOSTEROID INJECTION IN CHRONIC PLANTAR FASCIITIS-A short term follow-up study"** has been prepared by me under the able guidance and supervision of my guide **Prof.Dr.S.Elangovan, M.S.Ortho., D. Ortho., Professor,** Department of Orthopaedics,Coimbatore medical college, in partial fulfillment of the regulation for the award of **M.S. (ORTHOPAEDICS)** degree examination of The Tamilnadu Dr. M.G.R. Medical University, Chennai to be held in April 2012.

This work has not formed the basis for the award of any other degree or diploma to me previously from any other university.

Place : Coimbatore,

Date :

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ABSTRACT

TITLE: *A COMPARATIVE STUDY BETWEEN SINGLE DOSE INTRALESIONAL AUTOLOGOUS BLOOD AND CORTICOSTEROID INJECTION IN CHRONIC PLANTAR FASCIITIS*-A SHORT TERM FOLLOWUP STUDY

AIM OF THE STUDY:

1. To compare the effectiveness of single dose intra-lesional injection of autologous blood and corticosteroid in chronic plantar fasciitis.

2. To note the incidence of heel spur in chronic plantar fasciitis and to analyze the outcome of intra-lesional injections in patients with heel spur.

MATERIALS AND METHODS:

This study was done in Coimbatore medical college hospital during the period of June-October 2011 in the dept. of orthopaedics. 50 patients entered the study with 25 patients in each group. The patients were selected according to our inclusion and exclusion criteria and diagnosis made on clinical examination alone. The pain status was noted on the visual analog scale and the activity level noted based on the Nirschl stage. The patients were followed at 2, 4 and 12 weeks post-injection and the pain and activity level noted. The final outcome was based on our scoring system based on the pain status and the activity level at the end of 12 weeks duration and graded into 4 categories as excellent, good, and acceptable and poor. X-ray ankles of the patients were also taken to calculate the incidence of heel spur in chronic plantar fasciitis. The final outcome in the group with heel spur was also analyzed separately.

RESULTS/CONCLUSION:

We concluded that in chronic plantar fasciitis:

1. Local intra-lesional steroid injection gives better pain relief and faster return to activities of daily living compared to autologous blood injections.

2. Autologous blood injections also provide pain relief, although not comparable to steroids in the speed of recovery, but produces sustained effects and are easily available with no potential risk.

3. Heel spurs are present in 54 % of patients with chronic plantar fasciitis, compared to its 10% presence in general population.

4. The final outcome in patients with heel spurs was nearly comparable to those without heel spurs.

KEYWORDS:
1. Chronic plantar fasciitis
2. Intra-lesional injection
3. Autologous blood
4. Corticosteroid
5. Heel spur
6. Visual analog scale
7. Nirschl stage

INTRODUCTION:

Plantar fascia by repetitive overuse or overstretching gets inflamed resulting in a condition called as plantar fasciitis[1]. In chronic plantar fasciitis, inflammation and degeneration go hand in hand. This is one of the commonest chronic tendinopathies affecting humans. It typically affects both men and women in the age group of 40-70 yrs predominantly in women[1]. It occurs in 10% of the general population and is bilateral in 33% of cases.

AIM:

1. To compare the effectiveness of single dose intra-lesional injection of autologous blood and corticosteroid in chronic plantar fasciitis.

2. To note the incidence of heel spur in chronic plantar fasciitis and to analyze the outcome of intra-lesional injections in patients with heel spur.

ANATOMY OF THE PLANTAR FASCIA/APONEUROSIS:

The plantar fascia consists mainly of longitudinally arranged white colored fibres running from the calcaneum to the toes.

ATTACHMENTS:

Proximal: Attached to the medial tubercle of the calcaneum.

Distal: The fascia fans out into 5 slips against the metatarsophalangeal joints and gets attached to the base of the proximal phalanges of the respective toes.

The main parts are:

1. Central,

2. Medial, and

3. Lateral bands.

The central band is thicker and narrow proximally than is distally. It gets attached to the calcaneal tuberosity at its medial process. Distally it divides into 5 processes near the heads of the metatarsals, one for each toe. Each band divides into a superficial and a deep stratum against the metatarsophalangeal joint of the respective toes. The superficial stratum gets attached to the transverse sulcus of the skin. The deep stratum divides into two slips each engulfing the sides of the flexor tendons. They finally get attached to the

sheaths of their respective tendons and to the transverse metatarsal ligament and forms a series of arches through which the flexor tendons pass to the toes. The central portion is continuous with that of the lateral and medial ones. Two vertical intermuscular septae arise at the site where the medial and lateral bands join with the central one. These septae separate the three groups of plantar muscles (central, medial and lateral).

The medial portion is continuous with the central portion laterally and medially, it is continuous with the dorsal fascia. It is relatively thin compared with the other two portions and is attached posteriorly to the laciniate ligament.

The lateral portion is continuous with the central portion medially and laterally, it is continuous with the dorsal fascia. It is thicker posteriorly and thinner anteriorly.

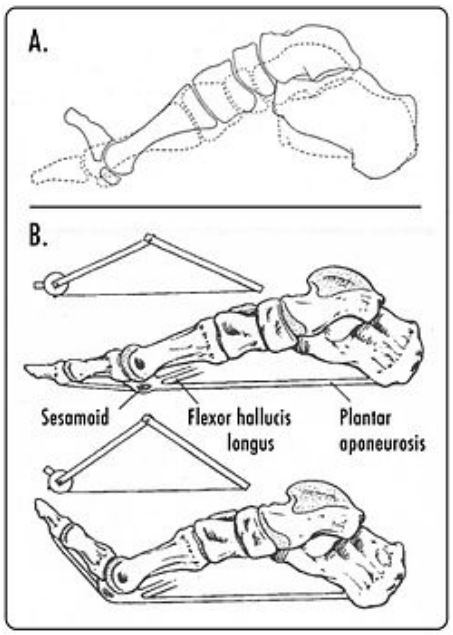
BIOMECHANICS OF THE PLANTAR FASCIA:

The plantar fascia contributes to the maintenance of the longitudinal arch of the foot. It undergoes tension when the foot normally bears weight, thereby maintaining the arch. According to a biomechanical study model, the plantar fascia bears 14% of the load of the foot[2]. In another cadaveric study, the plantar fascia failed only at loads as high as 1189 newtons[2].This failure most often occurred at the proximal attachment site at the calcaneum. This is consistent with the site involved in chronic plantar fasciitis, which is located at the calcaneum. Complete surgical release led to a decrease in the stiffness of the longitudinal arch of the foot.

The plantar fascia plays a vital role in the dynamic function during normal gait. It elongates to an extent of 9-12% between mid stance and toe off phase of gait, thereby to aid in propulsive movement. During the propulsive phase, the toes are dorsiflexed, thereby resulting in tension of the fascia which results in elevation of the longitudinal arch of the foot. This is likened to the windlass mechanism[2].

WINDLASS MECHANISM:

A windlass is a device used to move heavy weights. It was used in boats and ships to raise anchors. The plantar fascia is compared to the windlass mechanism. During normal weight bearing, the body weight is transmitted to the ground through the tibia and the talus. The ground reaction force tends to pass upwards from the calcaneus and the metatarsals. Both the above forces tend to collapse the medial longitudinal arch of the foot. The plantar fascia gets taut during dorsiflexion and prevents collapse of the medial longitudinal arch, thereby acting as a windlass or a tie-rod.



PATHOLOGY OF CHRONIC PLANTAR FASCIITIS:

Repetitive tensile overload of the plantar fascia at its attachment to the calcaneum leads to pathological changes similar to that seen in inflammation and degeneration. The pathology passes through a cascade of events including inflammation and degeneration[3]. There may be an associated heel cord contracture. But the real cause for the pain in chronic plantar fasciitis seems to be unclear till date[3]. According to some authors, the primary pathology in this condition is degeneration of the plantar fascia rather than true inflammation seen in acute conditions[4].

The plantar fascia gets attached to a relatively small area on the calcaneal tuberosity proximally. Distally it attaches to the base of the proximal phalanges of the toes which fans over a greater area. This arrangement exerts a greater pulling force at its proximal attachment site. Hence the maximum site of pain is at the calcaneum. This force creates a pull on the periosteum of the calcaneum. Periosteum is a pain sensitive part richly innervated by nerve fibres explaining the pain of plantar fasciitis. There also exists fibrous continuity of the plantar fascia into the bony matrix of the calcaneum thereby stimulating the overgrowth of new bone and resulting in the formation of a heel spur. The pathological changes are similar to that for other chronic tendinopathies and include inflammation, collagen degeneration, increase in ground substance and vascularity[4].

HEEL SPUR:

Plantar fasciitis and heel spur are considered to be the same by many. But in reality this is not true[1, 5]. Plantar fasciitis is a pathological diagnosis, whereas heel spur is a radiological finding. A heel spur may be present without any foot symptoms and a painful heel may not have a heel spur present always[5]. Heel spurs occur in 15% of population[5]. The presence of heel spur may only suggest the diagnosis of plantar fasciitis, but are not confirmatory evidence.

Heel spurs can occur in 2 distinct locations:

1. Back of the heel in chronic Achilles tendinitis,

2. under the heel in chronic plantar fasciitis.

Development of heel spurs:

Heel spurs develop as a result of bony outgrowth at the site of attachment of the plantar fascia to the calcaneum[6]. The stress is maximal in the plantar fascia at its calcaneal attachment and hence it's repetitive over pull results in bony overgrowth.

The below picture shows a heel spur under the heel as can be seen in chronic plantar fasciitis (the red arrow points towards the heel spur).

HEEL SPUR

Heel spurs usually occur in middle aged people and in athletes, it can occur at an even early age. This is due to the repeated stress on their heels. Abnormal gait may also lead to its development. In persons with abnormal gait pattern, the foot strikes the ground regularly in an unusual manner that leads to repeated stress and stretching of the plantar fascia that result in bony overgrowth leading to the development of a heel spur[6].

CAUSES OF CHRONIC PLANTAR FASCIITIS:

The most common cause is the presence of very tight calf muscles which results in excessive over pronation of the foot. This leads to overstretching of the plantar fascia resulting in inflammation/degeneration of the fascia. Similarly over supination can also lead to altered foot biomechanics predisposing to its development. Other causes may be very high or very low arched feet and regular use of footwear with poor arch support.

RISK FACTORS[1]:

Foot abnormalities including:

1. Very high arched feet,

2. Very low arched feet,

3. Flatfeet,

4. Rigid feet,

Other risk factors are:

5. Increased age,

6. Family tendency,

7. Poor/altered gait pattern,

8. Poor arch support in footwear,

9. Tight calf muscles and

10. Excess body weight.

CLINICAL FEATURES:

-Heel pain.

-Tenderness under the heel may be present.

-Heel pain is usually maximal in the early morning as the person gets up from bed as the fascia gets tight overnight and gets lessened as the foot gets warmed up. Later on, the pain may persist throughout the day[7].

DIAGNOSIS:

Clinical examination alone forms the basis of the diagnosis[8, 9].

-Mild swelling,

-Redness +/-,

-Tenderness under the heel.

INVESTIGATIONS:

-X-rays may be done to rule out other conditions, but are not absolutely necessary.

-USG-May show thickened plantar fascia, but are not diagnostic.

-MRI scan is done only if pain persists despite all treatment regimes and only to rule out other causes of heel pain.

DIFFERENTIAL DIAGNOSIS OF HEEL PAIN[7]:

1. Neurologic like entrapment syndromes,

2. Calcaneal stress fracture,

3. Skeletal causes like Paget's disease,

4. Tumours,

5. Calcaneal apophysitis,

6. Fat pad syndrome,

7. Bursitis,

8. Tendinitis, etc.

TREATMENT OF CHRONIC PLANTAR FASCIITIS:

There are several treatment options available for chronic plantar fasciitis. The initial treatment is usually with conservative means including rest, ice packs, NSAID'S and footwear modifications[7, 10, 11].

Most of the patients get relieved of their pain with this treatment regime. Patients with pain not responsive to the above treatment protocol are subjected to more aggressive modalities. The available treatment options can be classified as:

1. Conservative and

2. Invasive.

CONSERVATIVE TREATMENT:

REST/IMMOBILIZATION:

Rest is usually the initial recommendation for most patients. But rest/immobilization can be continued only for short periods and is beneficial only in acute cases where inflammation is supposed to be the primary pathology. But in chronic cases where degeneration also exists, rest has got a very limited role, but still can be tried.

ICE THERAPY:

Ice packing is a form of treatment where ice packs are applied locally to the site of inflammation. This helps to reduce the pain associated with inflammation.

NIGHT SPLINTS:

Night splints are tried with the hope of maintaining the limb in a neutral position. One major risk factor for chronic plantar fasciitis is the presence of very tight calf muscles. This treatment aims to solve it by splinting and maintaining the limb in a neutral position, thereby the plantar fascia is stretched and elongated and hence healing may occur in that position.

MASSAGE:

Friction massage is by which mechanical breakdown of tissue occurs. But long term reports are not available.

ORTHOTICS:

Heel pads and arch supports are the common orthotics advised to patients with chronic plantar fasciitis. Heel pads are made up of silicone, rubber or gel foam. They absorb the shock of uneven weight bearing thereby reducing the stress on the plantar fascia. Arch supports are given to the shoes to maintain the

longitudinal arch of the foot in patients with very high or very low arched and flatfeet[12, 13].

STRETCHING:

Stretching of the plantar fascia can be useful for chronic cases.

NSAID'S:

NSAID'S are non steroidal anti-inflammatory drugs that acts by inhibiting the enzyme cyclooxygenase which catalyses the formation of prostaglandins. Prostaglandins are primary mediators of inflammation. By inhibiting the formation of prostaglandins, inflammation is reduced. Hence its use in acute cases seems to be logical. Also long term intake of analgesics is not advisable as it results in gastrointestinal bleeding, renal and liver damage[14].

ULTRASOUND AND PHONOPHORESIS:

Mechanism of action:

High frequency ultrasound wave when delivered to a targeted tissue breaks them down by heating the tissues. In chronic plantar fasciitis, this has a role by breaking down the involved fascial tissues.

Phonophoresis is a technique in which the target area is subjected to ultrasound waves after applying a cream of corticosteroid which drives the ultrasound waves deep into the tissues thereby breaking down the heated tissue.

EXTRACORPOREAL SHOCK WAVE LITHOTRIPSY (ESWL):

This is a relatively newer treatment method. It is also known as orthotripsy.Basically, there are two types of orthotripsy according to the waves that are generated. Studies show only poor results with its usage[15, 16].

High energy waves:

Advantages:

1. More effective than low energy waves,

2. May need lower sittings.

Disadvantages:

1. Require costly equipments,

2. May not be available at all centers,

3. Very painful during exposure,

4. Patient needs to be under anesthesia/sedation to tolerate pain.

Low energy waves:

Advantages:

1. No need for anesthesia,

2. Less expensive equipments,

3. Less painful during exposure.

Disadvantages:

1. May need multiple sittings,

2. Less effective compared to high energy waves.

LASER THERAPY:

Laser waves are delivered to the plantar fascia through one of the following 3 modes as given below:

1. LLLT-Low level laser therapy,

2. LED-Light emitting diodes,

3. SLD-Super luminous diodes.

ELECTRICAL STIMULATION/IONTOPHORESIS:

This works on the same principle as ultrasound waves do. A combination of applying a steroid cream over the affected area, followed by electrical stimulation is known as iontophoresis.Limited reports are only available to support its use.

INVASIVE:

PROLOTHERAPY/SCLEROTHERAPY:

Mechanism of action:

An irritant substance injected into an affected area stimulates the inflammatory cascade and allows the tissues to heal by scarring down the area. Its role in chronic plantar fasciitis is still at an investigational stage.

LOCAL INJECTIONS:

Several drugs/substances can be injected locally into the affected plantar tissues to bring about healing/resolution of the condition. Local/ Intra-lesional injections can be made accurate by localizing the affected tissue by ultrasound imaging[17]. Several studies indicate the relative advantage/disadvantage of one substance over the other[18, 19, and 20]. Some of the commonly injected substances are given below:

1. Corticosteroids,

2. Botulinum toxin,

3. Autologous blood,

4. Platelet rich plasma.

CORTICOSTEROID INJECTIONS:

Mechanism of action:

Corticosteroids exerts its anti-inflammatory effect by lipocortin-1 synthesis.Lipocortin-1 inhibits phospholipase A2 thereby preventing the formation of prostaglandins and leukotreines which are primary mediators of inflammation. It also inhibits various inflammatory events like white blood cell migration, chemo taxis, phagocytosis, etc.

Role in chronic plantar fasciitis:

The anti-inflammatory role of corticosteroids may not play a part here except in acute conditions. But the beneficial effect of corticosteroids in this condition seems to exist since long time. Corticosteroids are known to inhibit proliferation of fibroblasts and to decrease the synthesis of ground substances[21, 22]. The beneficial effect of steroid injection may be due to the above action rather than its anti-inflammatory role.

Mode of injection:

Injection of steroid is made after palpating the area of maximum tenderness. It is usually injected in combination with a local anesthetic agent to tolerate the immediate post-injection pain.

Advantages:

1. Very effective[23],

2. Even single injection may bring about resolution of the condition[24],

3. cost-effective,

4. Do not need expensive equipments.

Disadvantages:

1. Invasive procedure,

2. Cannot be done in patients with uncontrolled diabetes/hypertension,

3. Side effects are common which includes plantar fascial rupture, fat pad necrosis, etc[25, 26].

Commonly used preparations:

2 types of corticosteroids are used for treatment of chronic inflammatory musculoskeletal conditions.

1. Methylprednisolone acetate (moderately insoluble, long acting) and

2. Fluorinated hydrocortisone i.e. Betamethasone, Dexamethasone, etc (highly soluble, short acting).

Methylprednisolone acetate has 5 times the glucocorticoid action of prednisolone and is 1.25 to 1.5 times stronger than prednisolone. Betamethasone is 8 to 10 times potent than prednisolone[27].

BOTULINUM TOXIN INJECTIONS:

Botulinum toxin injections have been used for refractory plantar fasciitis in previous days. It can be injected into the plantar fascia at the site of tenderness or if it is due to tight calf muscles, injection is done into the muscle substance. Studies indicate some advantage of this injection compared to placebo[28].

Mechanism of action:

In the fascia, it relieves the pain by destroying the pain sensitive nerve fibres.If the injection is made into the tight calf muscles, it acts by causing muscle relaxation and decreasing muscle volume. Actions common to both these sites include decreasing central sensitization, decreasing sympathetic activity and reducing the accumulation of pain mediators like substance-p and glutamate.

AUTOLOGOUS BLOOD INJECTIONS:

This is injection of the affected tissue with the patient's own blood in small quantities. This is a relatively newer technique and has become an alternative to corticosteroid injections in recent times. Autologous blood injection was initially done by Edwards and Calandruccio in 2004 for tennis elbow with good outcome[29]. It was gradually extended for other tendinopathies and chronic inflammatory conditions.

Mechanism of action:

Autologous blood when injected into an area of inflammation/degeneration tends to provide cellular/ humoral mediators and growth factors. These growth factors tend to recruit stem cells and results in collagen synthesis and repair of the degenerated tissues resulting in healing[30].

Mode of injection:

Around 2 ml of venous blood of the patient is drawn and mixed with 1 ml of a local anesthetic and injected into the area of maximum tenderness.

Advantages:

1. No chance of reaction as the patient's own blood is injected,

2. Cost-effective,

3. No need for expensive equipment.

Disadvantages:

1. May take a long time to act,

2. Patient may not accept it.

PLATELET RICH PLASMA INJECTIONS:

Mechanism of action:

Similar to that of autologous blood, but here the same effect is brought about by centrifuged platelet rich plasma rather than the administration of whole blood.

Advantages:

1. No reaction to injected substance.

Disadvantages:

1. Needs centrifugation apparatus,

2. Need more quantities of blood to be drawn,

3. May need multiple injections,

4. Patient may need to restrict activities for few weeks.

COMPLICATIONS OF LOCAL INTRALESIONAL INJECTIONS:

1. Infection,

2. Cellulitis,

3. Nerve damage,

4. Plantar fascial rupture,

5. Heel pad necrosis and

6. Persistence/increase in pain.

Needle/ Percutaneous Fasciotomy:

Indications:

1. Plantar fasciitis not responding to conservative management for 6-9 months.

2. Patients not willing for operative procedures.

Surgical principle:

1. The local trauma and bleeding produced by the puncturing of the fascia may produce a physiological response similar to that seen with autologous blood injections.

2. May mechanically breakdown the calcifications in the fascia.

Technique:

A wide bore needle is introduced into the plantar fascia either blindly or under ultrasound guidance and multiple punctures are made in single or multiple sessions. This may also be combined with local anesthetic infiltration and is referred to as peppering technique of local anesthesia.

SURGERY:

Surgery for chronic plantar fasciitis is only for recalcitrant cases for which conservative treatment have been exhausted for a period of at least 6-9 months. Success rate ranges from 70 to 90%[31, 32]. The various surgical options are:

1. Plantar fascial release (complete/partial),

2. Excision of the heel spur,

3. Nerve decompression.

The surgical technique may be:

1. Open,

2. Endoscopic.

Complete plantar fascial release:

It involves release of the entire plantar fascia and has its own demerits and hence has almost been withdrawn. If at all release of the plantar fascia is to be considered, only a release of less than 40% is to be done to prevent collapse of the arch of foot.

Disadvantages/complications:

1. Collapse of the longitudinal foot arch leading to altered gait and mid tarsal pain due to altered biomechanics,

2. Infection,

3. Calcaneal fracture,

4. Posterior tibial nerve injury, etc.

RECENT ADVANCE:

Radiofrequency microtenotomy:

A probe is introduced into the plantar fascia and high frequency radio wave is introduced into it which burns the affected tissue. It also has its deleterious effect on pain transmitting sensory nerve fibres thereby relieving the pain. This technique is referred to as the coblation therapy[33].

TREATMENT OF HEEL SPURS:

Heel spurs are usually satisfactorily treated by conservative means like NSAID'S, orthotics, heel stretching, and etc[6]. In cases with heel spurs that are not responsive to the above treatment methods, excision of the spur may be considered.

LITERATURE REVIEW:

-Chronic plantar fasciitis is known to be a chronic inflammatory foot condition since time immemorial.

-Lemont et al in 2003 studied 50 cases labeled as chronic plantar fasciitis and evidenced very little inflammatory cells and hence said this condition be better called as plantar fasciosis[34].

- Barnett, in 2004 pointed out that inflammatory cells are least evident in this condition and called the term plantar fasciitis to be a misnomer. He considered the pathology to be a degeneration of the plantar fascia[34].

-Khan et al also committed that the pathology in this condition is collagen degeneration as with other tendinopathies.

-Treatment for plantar fasciitis is conservative at the beginning, consisting of non-steroidal anti-inflammatory drugs (NSAID'S), plantar fascia night splints, well-cushioned shoes, heel pads or heel cups, orthotics, and physical therapy. Stretching of the plantar fascia and heel cord is often beneficial[7].

-In changi general hospital, Singapore, study was conducted to determine the rear foot pressures in cases with heel spurs. It reported uneven pressure distributions in such cases and rear foot pressure was reduced with the use of customized orthotics[12].

-According to Dr. Weil, Cryo ablation has been in use since 2003 with over 5000 cases of chronic plantar fasciitis treated with this all over United States. The overall success rate ranged between 80-93 percent[33].

-Haake, Buchbinder reported poor results with extracorporeal shock wave lithotripsy, whereas Ogden reported good results[15, 16, and 20].

-Babcock et al. studied the effectiveness of botulinum toxin injections and produced good results in terms of pain relief[28].

- Crawford and Gudeman concluded that intra lesional steroid injections are beneficial in acute cases and in short term therapy. But the incidence of complications related to steroids were high and included plantar fascial rupture, calcaneal fracture and calcaneal osteomyelitis[23].

-Calandruccio and Edwards in 2004 tried intra lesional autologous blood injections for recalcitrant tennis elbow and produced good results[29].

-Barrett et al extended the application of autologous blood to plantar fasciitis and reported similar results. He also used autologous platelet concentrate for the same condition and obtained similar results. This technique of injection of platelet concentrate into the lesion of plantar fasciitis was attributed by him as plantar fasciorraphy[34].

-Dr.Martin Robert presented his results in AMSSM meeting with the use of intra lesional autologous blood that it is a safe and simple alternative technique that gives results better than other standard treatments in recalcitrant cases.

- Lee TG and Ahmad TS conducted a comparative study between autologous blood and corticosteroid injection in chronic plantar fasciitis and reported that autologous blood was found to be effective in lowering the pain associated with the condition, but corticosteroids were much better in speed and the overall outcome of recovery[19].

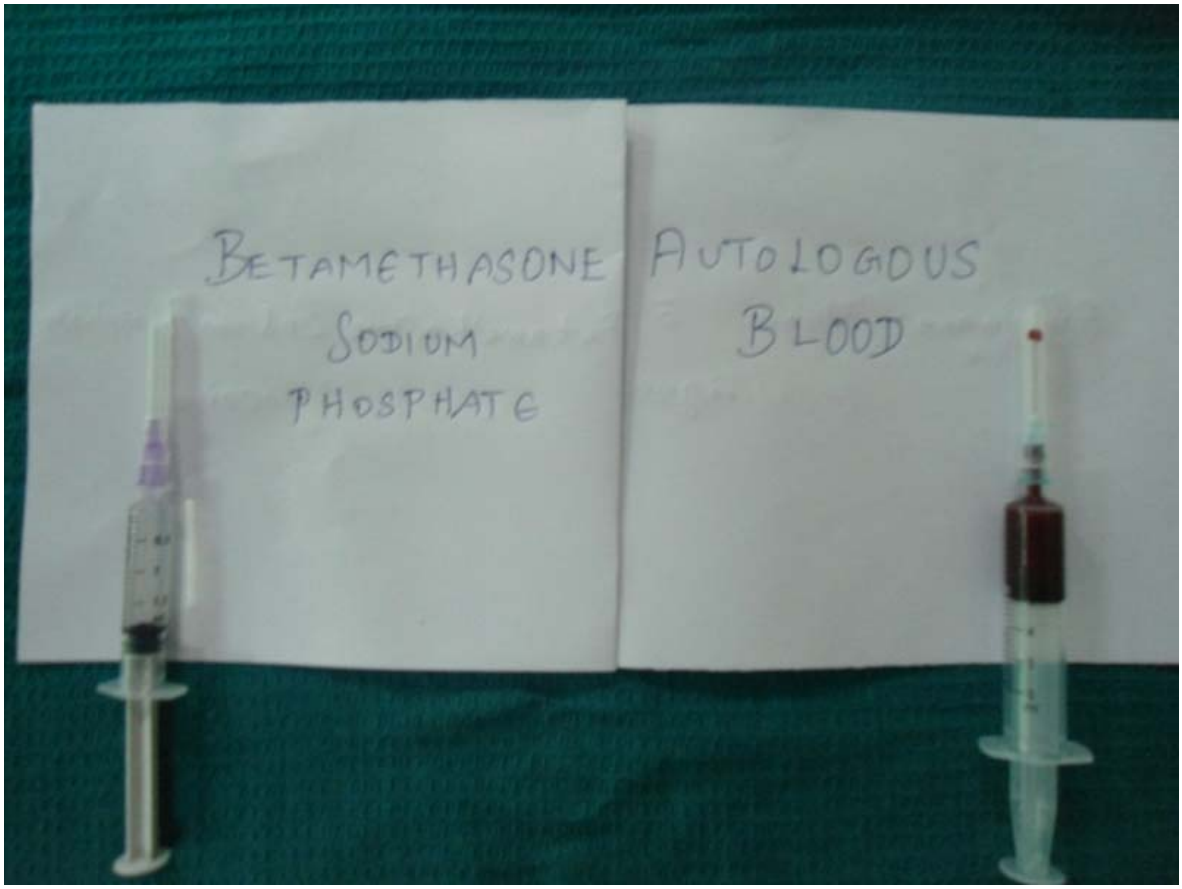
-Kiter et al in 2006 published in JAPMA that the results of intra lesional injection of corticosteroids, autologous blood and peppering technique are equally comparable[35].

DRUGS USED:

1. 2 ml of autologous blood with 1 ml of 2% lignocaine

2. 2 ml of betamethasone sodium phosphate (8mg) with 1 ml of 2% lignocaine.

Betamethasone sodium phosphate was used since it had a combination of features like high potency and high solubility[3]. Usage of insoluble steroids in soft tissue disorders is not recommended. Also it is cost-effective compared to other steroids.



AUTOLOGOUS BLOOD:

BETAMETHASONE SODIUM PHOSPHATE:

MAIN OUTCOME MEASUREMENTS:

The main outcomes measured were subjective based on the visual analog scale and the nirschl stages done pre-injection, 2, 4 and 12 weeks post-injection. Final outcome was measured based on the pain and activity level at 3 months. Incidence of heel spurs in chronic plantar fasciitis and the outcome of our injections in patients with heel spurs were analyzed.

NIRSCHL STAGING:

According to this, pain and activity level are categorized in 7 stages:

0. No pain

1. Mild pain with exercise which resolves within 24 hours.

2. Pain after exercise which exceeds 48 hours.

3. Pain with exercise, but allows normal activity.

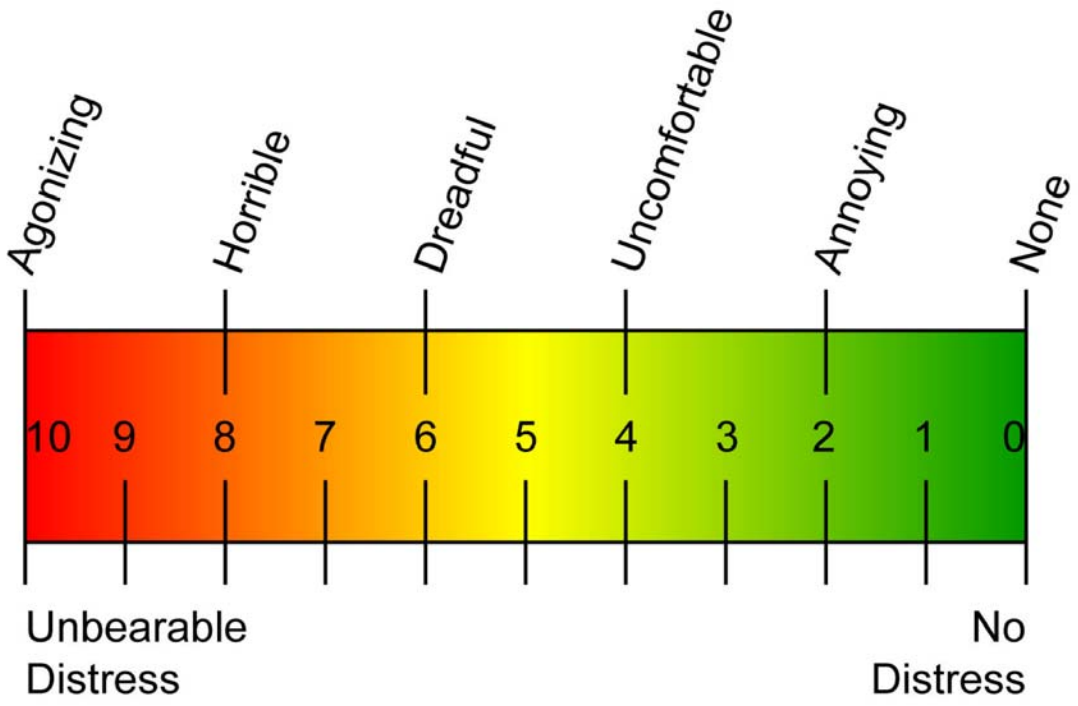
4. Pain with exercise which interferes with normal activities.

5. Pain with heavy activities of daily living, but able to do light activity.

6. Pain with light activities of daily living and intermittent rest pain.

7. Constant pain at rest and sleep.

VISUAL ANALOG SCALE



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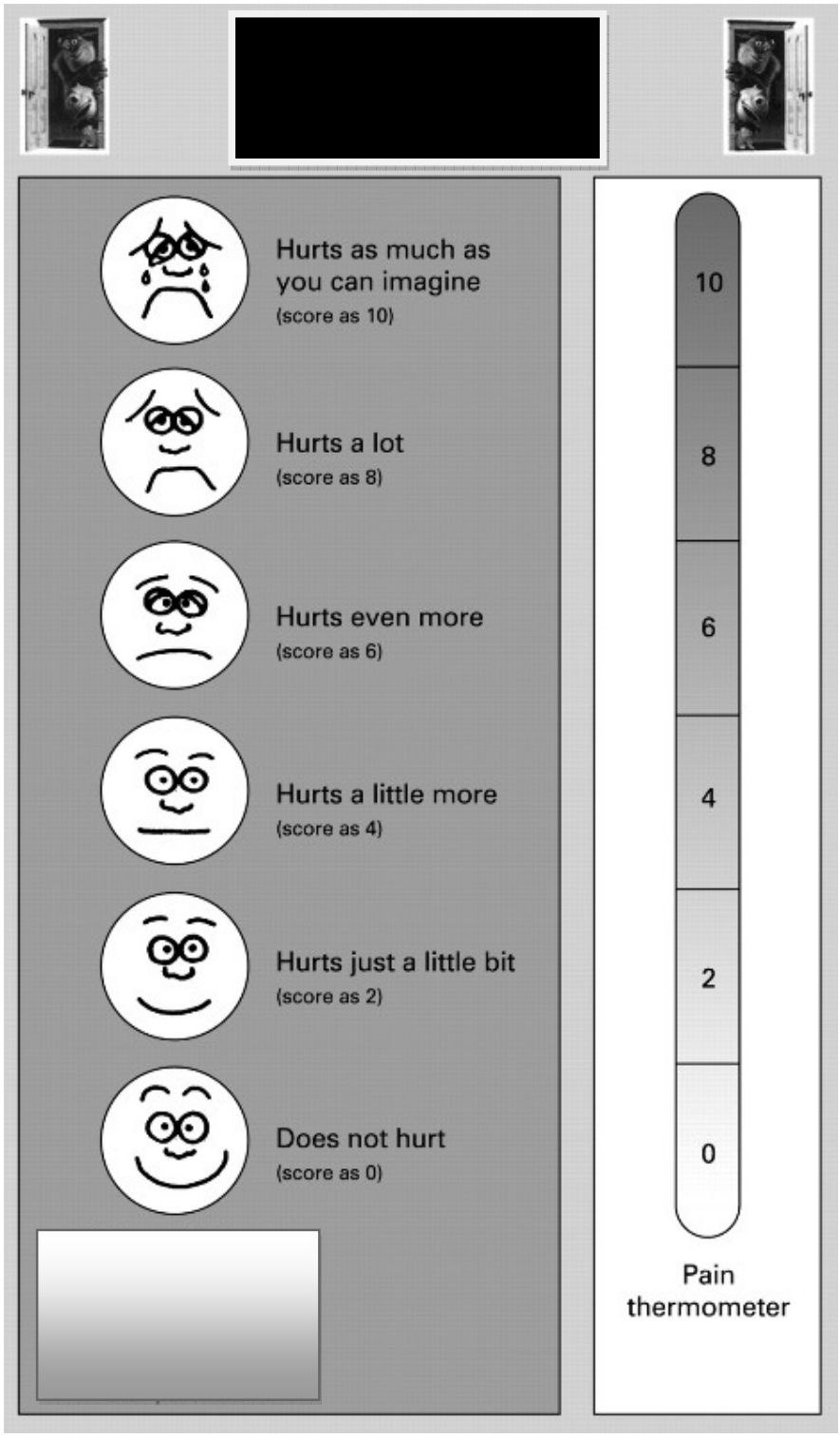
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(score as 2)
Does not hurt
(score as 0)
10
8
6
4
2
0
Pain thermometer

FINAL OUTCOME SCORING SYSTEM:

Excellent: No pain, full movement and activity.

Good: Occasional pain, full movement and activity.

Acceptable: Some discomfort after prolonged activity.

Poor: Pain limiting activity.

PATIENTS AND METHODS:

This was a prospective study of 50 cases of clinically diagnosed chronic plantar fasciitis treated with single dose intra lesional injection of autologous blood and steroid (25 cases each) during the period of June-Oct 2011 in Coimbatore medical college hospital, Coimbatore.

INCLUSION CRITERIA:

1. Unilateral heel pain > 6 weeks,

2. Has taken conservative treatment with oral analgesics, foot wear modification and physiotherapy modalities for > 4 weeks, with no improvement,

3. Not undergone previous local injections in the heel,

4. Accepting for further treatment after the study period if pain persists,

5. Willing for follow-up,

6. Normotensive, Normoglycaemic patients.

EXCLUSION CRITERIA:

1. Bilateral heel pain,

2. Has undergone previous local injections,

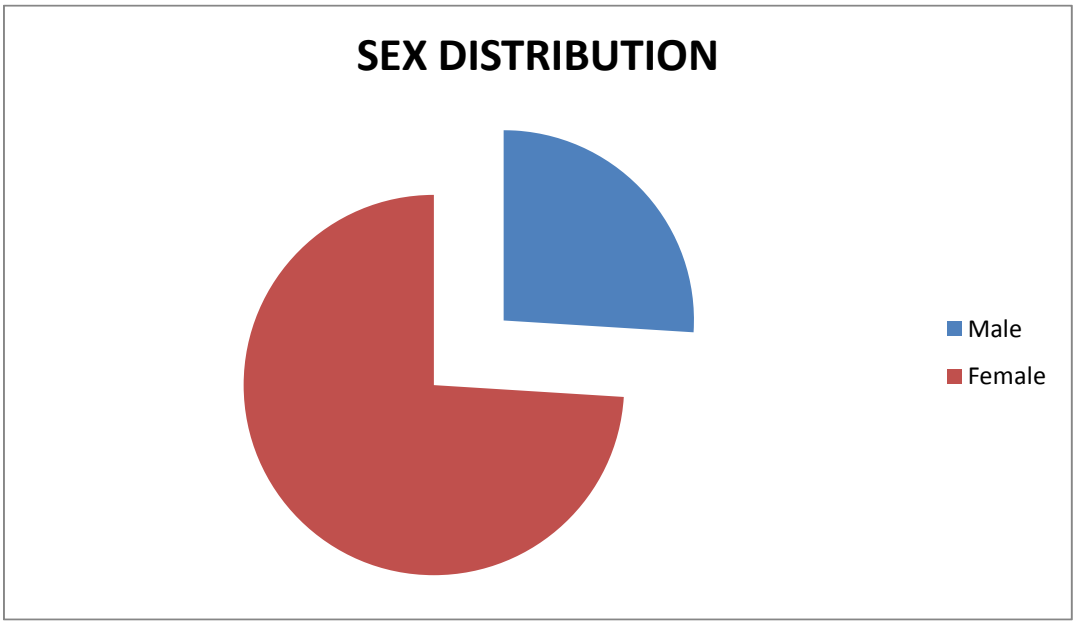
3. Not willing for follow-up,

4. Patients with other medical illnesses.

PATIENTS:

Between the above mentioned period, 50 cases of unilateral plantar fasciitis who met the above criteria entered the study.

There were 13 males and 37 females with a mean age of 43.06 years. Range was age 23-69 years.



SIDE DISTRIBUTION

Left:35

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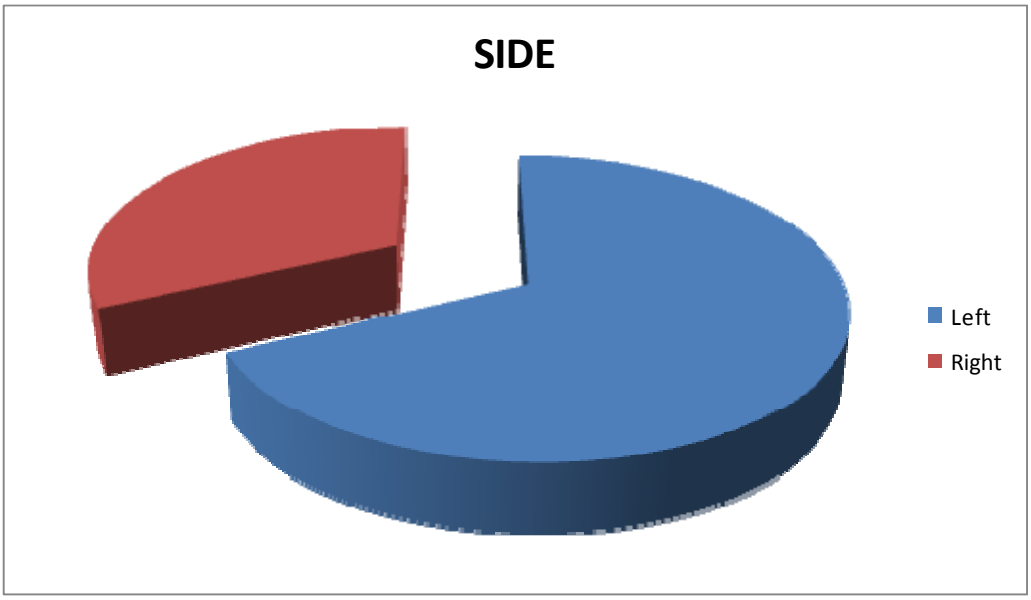
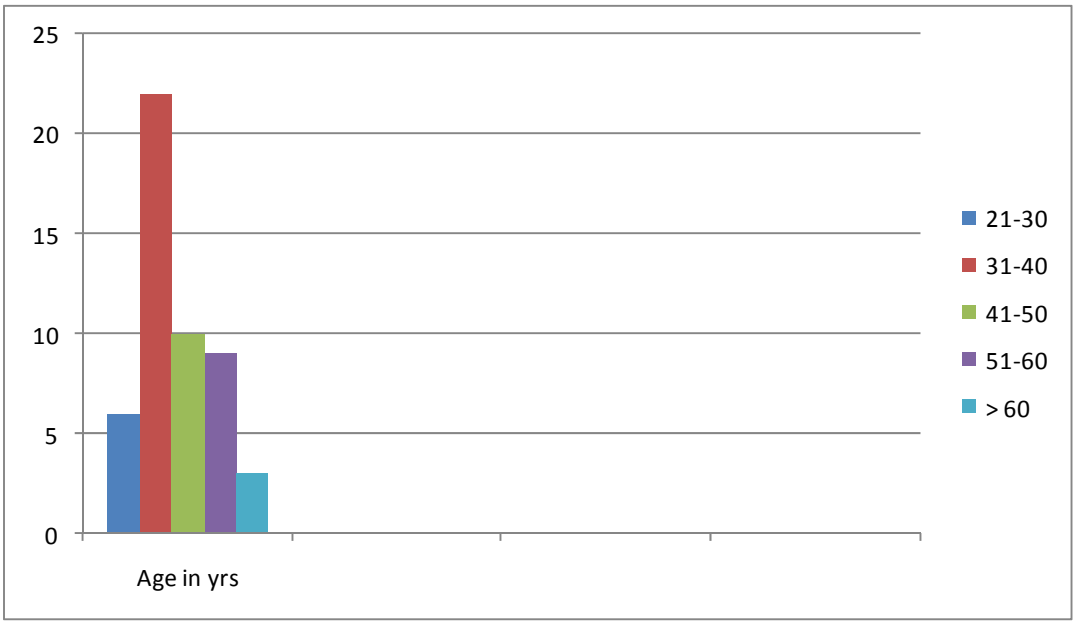


AGE DISTRIBUTION



The mean duration was 6.26 months.

The average pre-injection scores were:

1. Blood injection group:

VAS: 6.28

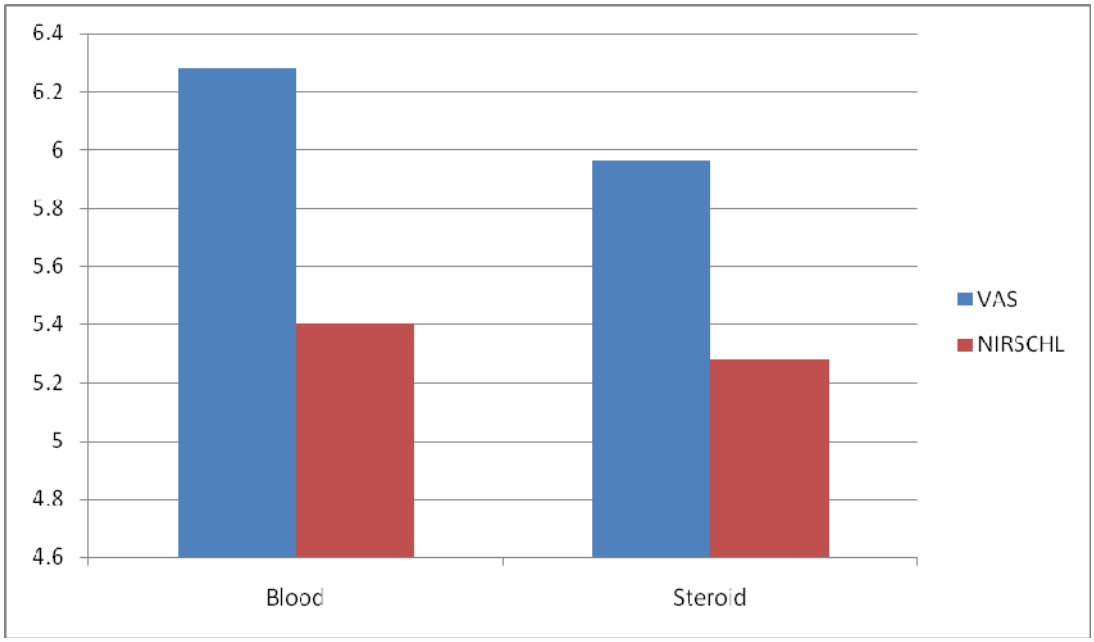
Nirschl: 5.40

2. Steroid injection group:

VAS: 5.96

Nirschl: 5.28

PRE-INJECTION SCORES



INJECTION PROTOCOL:

1. Patients who met our inclusion criteria were randomly allocated to either of the two groups.

2. Consent was obtained after explaining the study, benefits and complications of the procedure and regarding the need for regular follow-up.

3. X-ray ankle-lateral view was taken for all cases before injection to document the presence/absence of heel spur.

INJECTION TECHNIQUE:

1. In case of autologous blood injection, 2 ml of the venous blood was drawn from the patient him/ herself and mixed with 1 ml of 2% lignocaine.

2. In case of steroid, 2 ml of Betamethasone sodium phosphate amounting to 8 mg was mixed with 1 ml of 2% lignocaine.

3. Sterile aseptic precautions were followed.

4. The site of maximum tenderness in the heel was located by careful palpation.

5. The injection was made through the medial/lateral aspect of the foot.

6. If the injection is made through the plantar aspect, care was taken not to inject it superficially to avoid the risk of fat pad necrosis.

7. After the injection, patient was allowed to follow our post-injection protocol.

POST-INJECTION PROTOCOL:

1. Ice therapy,

2. Compression bandage,

3. Advised not to take NSAID’S for at least 4 weeks post-injection unless pain persisted/increased,

4. No activity restrictions.

FOLLOW-UP:

- All the patients were followed up at 2, 4 and 12 weeks post-injection.

- A total of 7 patients did not return for the final follow-up at 12 weeks which included 4 in the steroid group and 3 in the autologous blood group.

- At follow up, pain was assessed using the visual analog scale and Nirschl stages and compared with their respective pre-injection levels.

- Final Outcome was measured based on the pain and activity levels and graded into 4 categories.

- Patients were also observed for complications if any at the injection site.

- Radiographs were analyzed for the presence of heel spur.

COMPLICATIONS:

1. In steroid group, 1 patient had paraesthesia at the injection site at 2 weeks post-injection, but it disappeared at 4 weeks with observation alone.

2. No case of infection/ cellulitis, plantar fascial rupture, heel pad necrosis was observed.

DATA ANALYSIS:

POST-INJECTION SCORES:

The average post-injection scores at 2 weeks were:

1. Blood injection group:

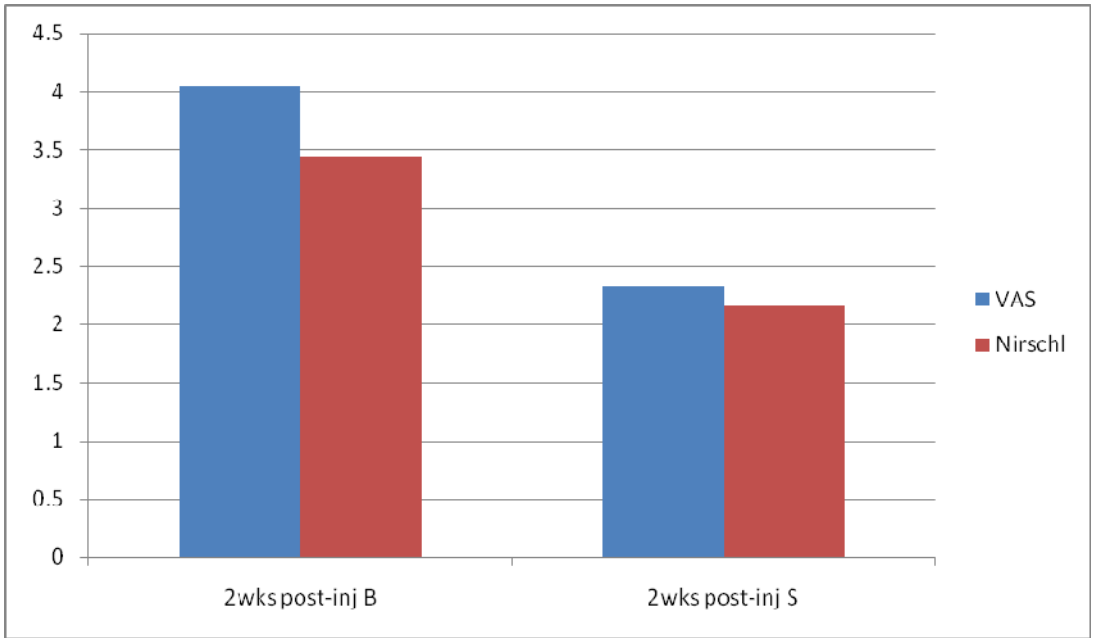
VAS: 4.04

Nirschl: 3.44

2. Steroid injection group:

VAS: 2.32

Nirschl: 2.16



The average post-injection scores at 4 weeks were:

1. Blood injection group:

VAS: 4.56

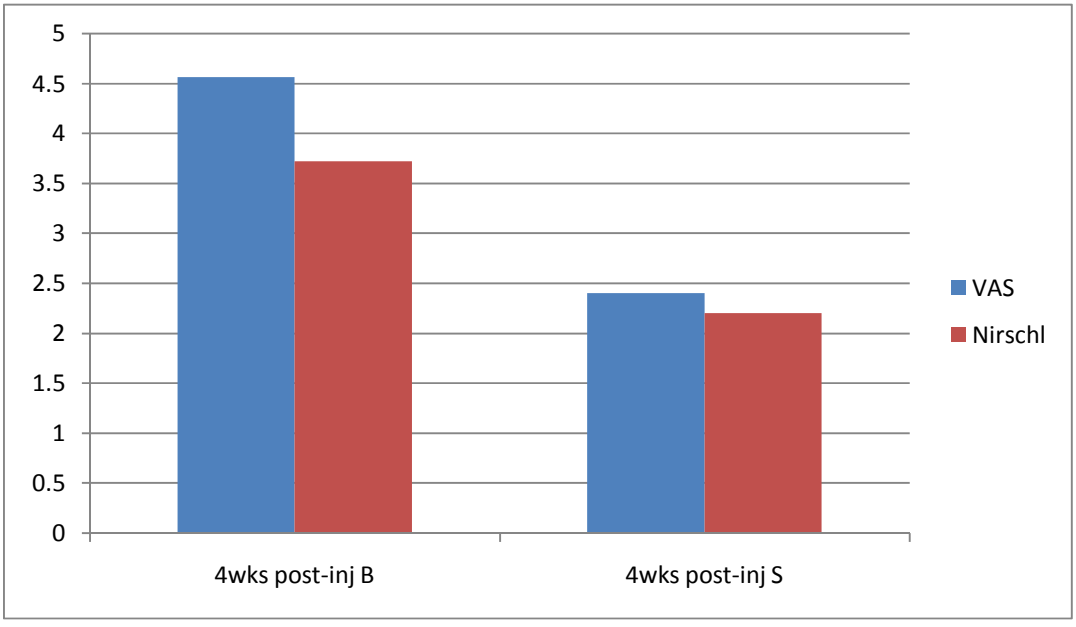
Nirschl: 3.72

2. Steroid injection group:

VAS: 2.40

Nirschl: 2.20

POST INJECTION SCORES (4 wks)



The average post-injection scores at 12 weeks were:

1. Blood injection group:

VAS: 4.22

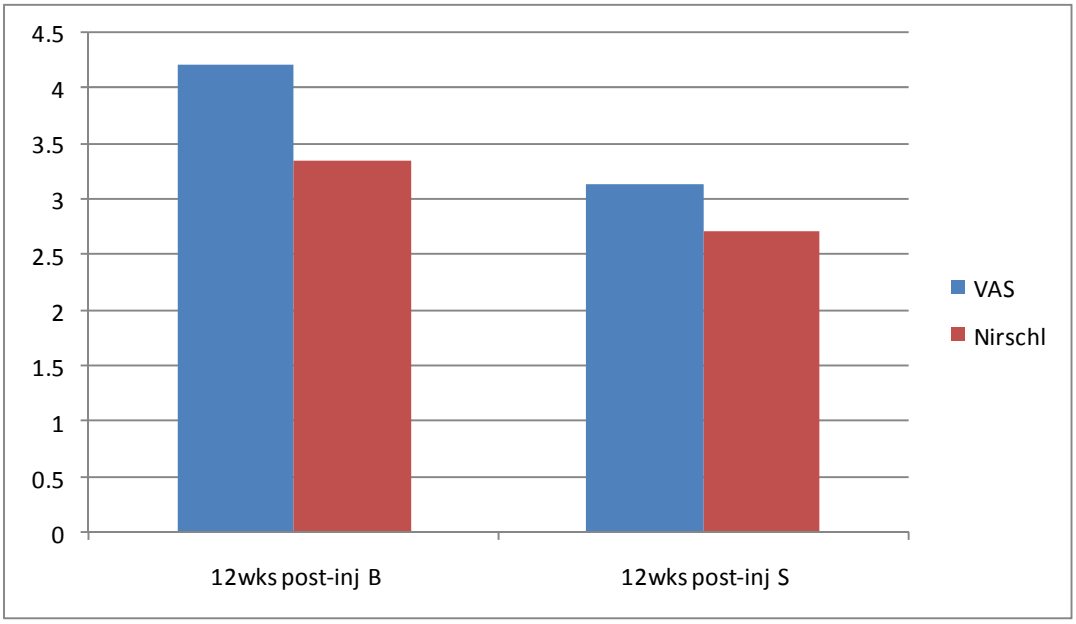
Nirschl: 3.36

2. Steroid injection group:

VAS: 3.14

Nirschl: 2.71

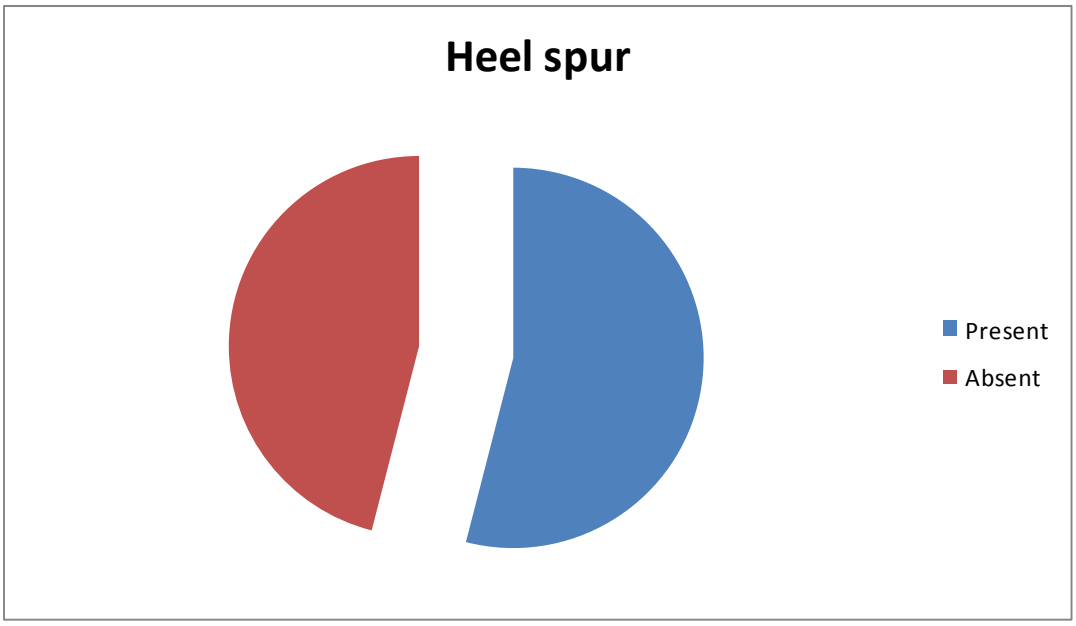
POST INJECTION SCORES (12 wks)



ANALYSIS OF HEEL SPURS:

Present:27pts(54%)

Absent:23pts(46%)



RESULTS:

The average VAS and Nirschl scores in both the groups pre-injection, 2,4 and 12 weeks post-injection are shown in the below tables.

AUTOLOGOUS BLOOD GROUP

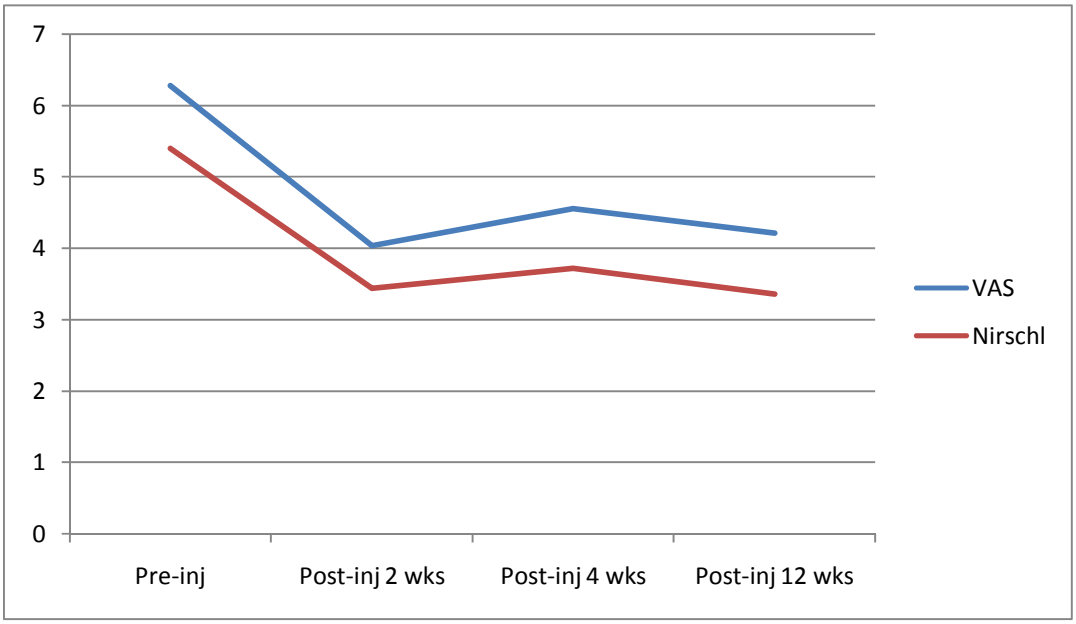
Pre-injection		Post-injection(2 wks)		Post-injection(4 wks)		Post-injection(12 wks)	
VAS	Nirschl	VAS	Nirschl	VAS	Nirschl	VAS	Nirschl
6.28	5.40	4.04	3.44	4.56	3.72	4.22	3.36

STEROID GROUP

Pre-injection		Post-injection(2 wks)		Post-injection(4 wks)		Post-injection(12 wks)	
VAS	Nirschl	VAS	Nirschl	VAS	Nirschl	VAS	Nirschl
5.96	5.28	2.32	2.16	2.40	2.20	3.14	2.71

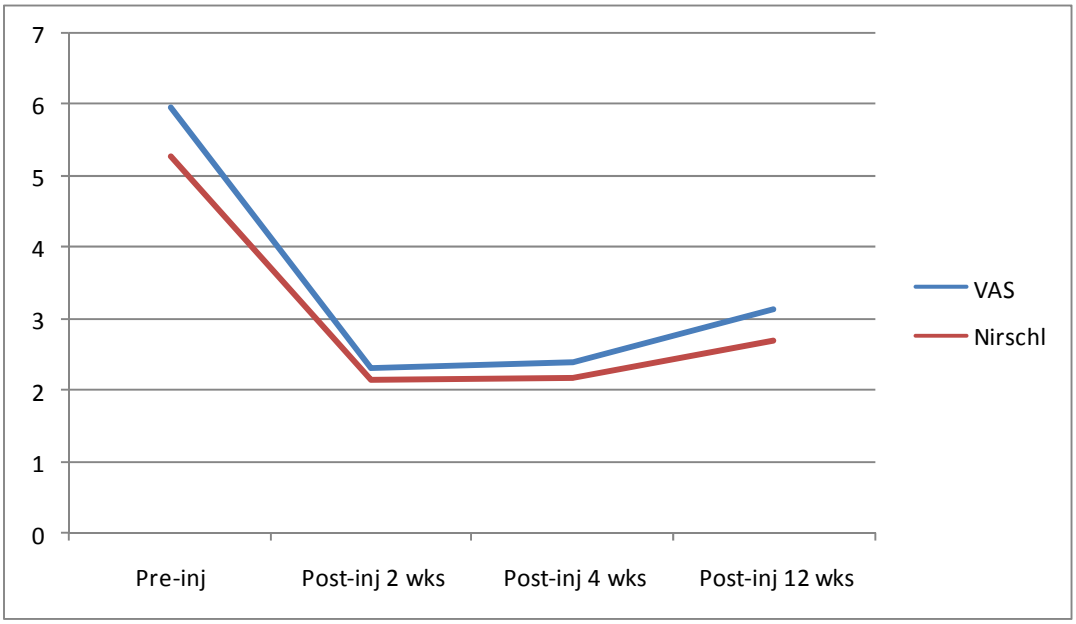
The effects of our injection as observed with the VAS and Nirschl scores in both the groups is depicted in a graph given below:

AUTOLOGOUS BLOOD GROUP



From the above curve it is clear that the autologous blood group followed a gentle curve during the 2 weeks after injection compared to that of the steroid curve. At the end of 12 weeks, the effect is still sustained shown by its down coming curve pattern.

STEROID GROUP



From the above curve it is clear that the steroid group had a steep curve during the 2 weeks after injection compared to that of the autologous blood group curve. At the end of 12 weeks, the effect has weaned off shown by its up going curve pattern.

To conclude, the VAS score in the autologous blood group decreased by 2.06 and the Nirschl score decreased by 2.04 in the 12th week compared to pre-injection scores.

Whereas, the VAS score in the steroid group decreased by 2.82 and the Nirschl score decreased by 2.57 in the 12th week compared to pre-injection scores.

According to the final outcome assessment scoring, the results at post-injection 12 weeks were as follows:

AUTOLOGOUS BLOOD GROUP:

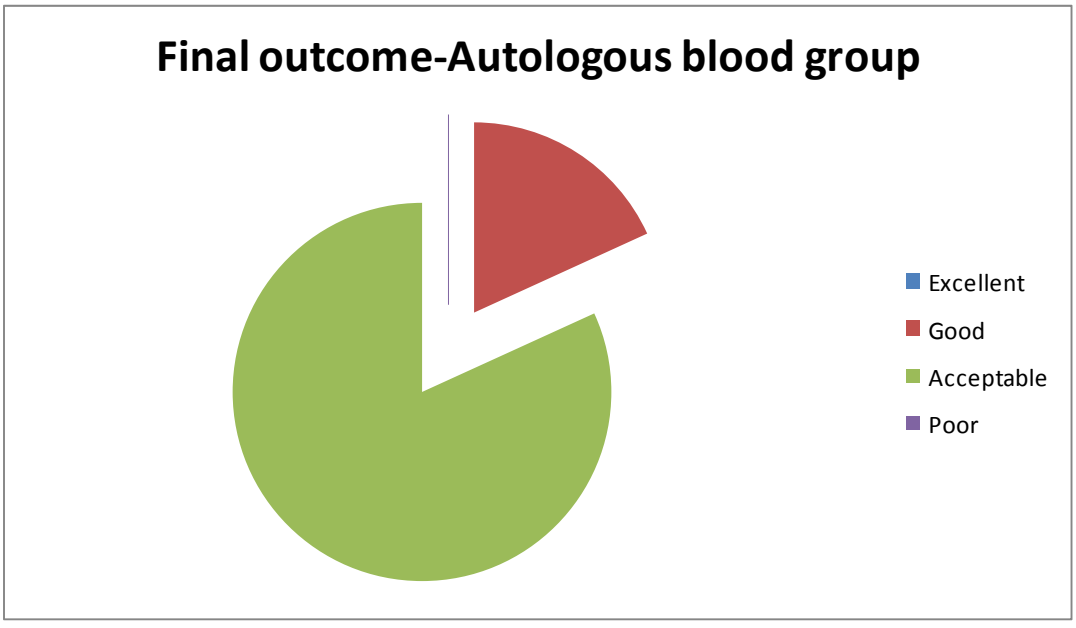
Grade-1(Excellent): 0

Grade-2(Good): 4

Grade-3(Acceptable): 18

Grade-4(poor):0

Lost follow-up: 3



STEROID GROUP:

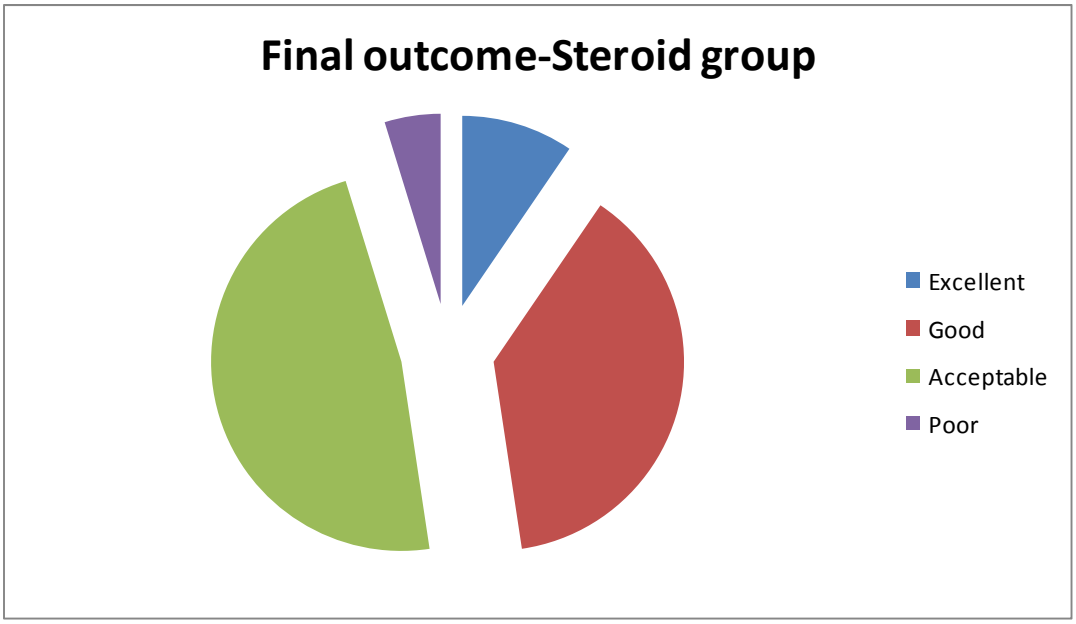
Grade-1(Excellent): 2

Grade-2(Good): 8

Grade-3(Acceptable): 10

Grade-4(Poor): 1

Lost follow-up: 4



FINAL OUTCOME WITH RELEVANCE TO HEELSPUR:

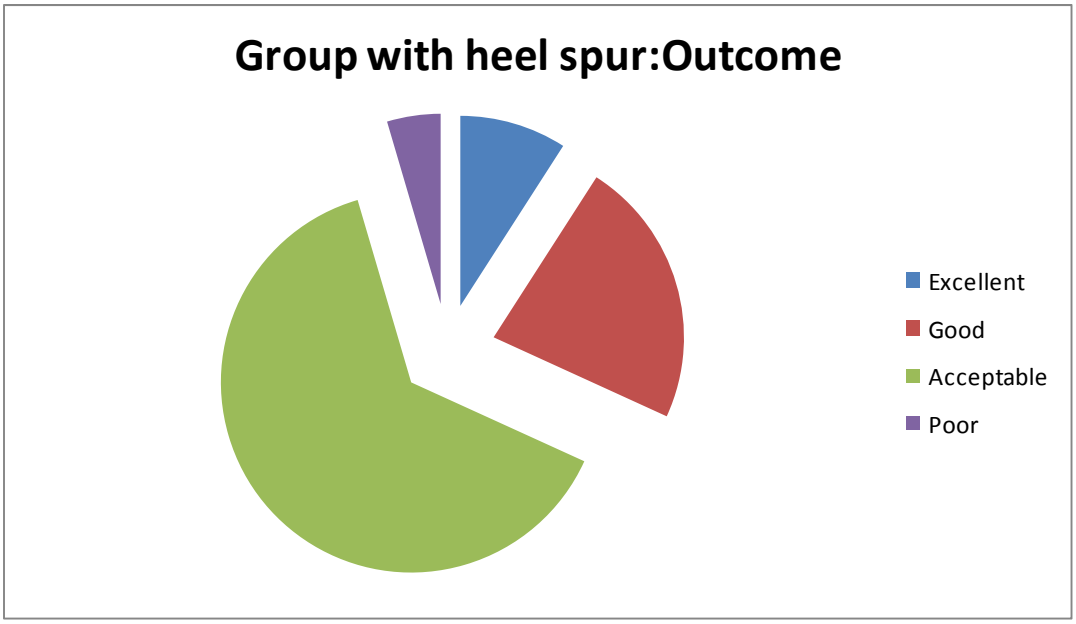
GROUP WITH HEELSPUR:

Excellent: 2(9.09%)

Good: 5(22.72%)

Acceptable: 14(63.63%)

Poor: 1(4.54%)

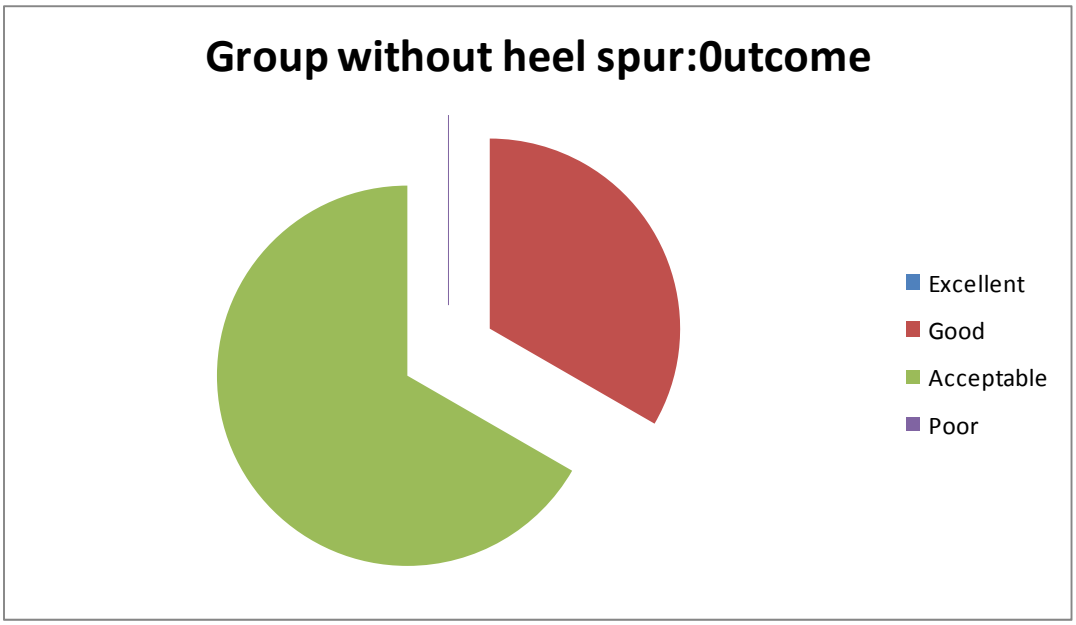


GROUP WITHOUT HEELSPUR:

Good: 7(33.33%)

Acceptable: 14(66.66%)

Excellent & Poor: 0



The final outcome in patients without heel spur was only marginally better than in those with heel spur. In the group with heel spur 22.72% had good outcome and 63.63% had acceptable outcome. In the group without heel spur 33.33% had good outcome and 66.66% had acceptable outcome. There were also 2 patients with excellent outcome in the group with heel spur whereas there were none with excellent outcome in the group without spur. Hence, the final

outcomes in patients with heel spur were nearly comparable to that in patients without heel spur.

DISCUSSION:

Plantar fasciitis literally means inflammation of the plantar fascia at the site of its attachment to the calcaneum. But recent studies indicate that it is a condition of degeneration of the plantar fascia rather than true inflammation.Dr.Barrett in 2004 suggested that it is really a degeneration of the plantar fascia and called it better as plantar fasciosis. It was also supported by the findings of pathologists that only very few inflammatory cells were found in specimens received from cases of chronic plantar fasciitis[34]. The pathology passes through a cascade of events including inflammation and degeneration[3]. True inflammation is found only in acute cases and in chronic stages, inflammation and degeneration exists together with degeneration dominating the other. This is alike other chronic tendinopathies wherein the features of loss of collagen continuity, increase in ground substance, vascularity and fibroblasts predominate the lesion[4]. Several treatment methods exist for chronic plantar fasciitis which are broadly classified into conservative and invasive. Initially treatment is begun with a combination of conservative methods including rest, ice pack application, NSAID'S, footwear modifications including arch supports[7, 10, and 11]. Usually multiple sessions of the modalities like ultrasound waves, electrical stimulation, phonophoresis may be required before resolution of the condition can occur. When it is not responsive to the above conservative treatment options, local intra-lesional injections or surgical plantar fascial release can be considered. Local intra-lesional injections of

corticosteroids, botulinum toxin, autologous blood and platelet rich plasma can be tried. Several studies indicate the advantage/disadvantage of one treatment option over the other[18, 19, and 20].

Autologous blood injection for treatment of chronic plantar fasciitis exists in the medical literature only for the past 6 yrs. Edwards and Calandruccio tried intra-lesional autologous blood injections for tennis elbow and obtained complete pain relief with 1 or 2 injections in all his patients[29]. It was Dr.Barrett who initially tried autologous blood injections for plantar fasciitis with good results[30]. Based on the fact that the pathology in chronic tendinopathies is similar, this treatment was extended to chronic plantar fasciitis.

Recently, Martin et al studied the effect of intra-lesional autologous blood injections in chronic plantar fasciitis in over 200 patients and reported good results nearing 80%.

In our study, in the autologous blood group, 18% had good and 82% had acceptable outcomes.

Kane et al conducted a study of intra-lesional corticosteroid injections in chronic plantar fasciitis and found 70% better results.

Furey et al also reported similar results.

In our study, in the steroid group, 38% had good, 48% had acceptable and 10% had excellent outcomes.

Lee TG and Ahmad TS conducted a comparative study between autologous blood and corticosteroid injection in chronic plantar fasciitis and reported that autologous blood was found to be effective in lowering the pain associated with the condition, but corticosteroids were much better in the speed and the overall outcome of recovery[19].

From the results extrapolated in the graph as discussed before, the autologous blood group had a descending/down coming curve pattern at the end of 3 months, whereas the steroid group had an ascending/up going curve pattern. This is due related to a late and sustained beneficial effect of autologous blood. Steroid injections provide faster and better relief of pain compared to autologous blood, but the beneficial effect is only short lived.

Heel spurs may be present in patients with chronic plantar fasciitis.15% of the general population have heel spurs[5], whereas only 5% of people with heel spurs are symptomatic, with the rest 95% being without any symptoms relating to the foot. In our study, 54% of patients had heel spurs. In the group with heel spur 22.72% had good outcome and 63.63% had acceptable outcome. In the group without heel spur 33.33% had good outcome and 66.66% had acceptable outcome. There were also 2 patients with excellent outcome in the group with

heel spur. Hence, the final outcomes in patients with heel spur were nearly comparable to that in patients without heel spur.

In our study, 1 patient in the steroid group had poor outcome and was advised another intra-lesional injection of the same substance.

CONCLUSION:

We conclude that in chronic plantar fasciitis:

1. Local intra-lesional steroid injection gives better pain relief and faster return to activities of daily living compared to autologous blood injections.

2. Autologous blood injections also provide pain relief, although not comparable to steroids in the speed of recovery, but produces sustained effects and are easily available with no potential risk.

3. Heel spurs are present in 54 % of patients with chronic plantar fasciitis, compared to its 10% presence in general population.

4. The final outcome in patients with heel spurs was nearly comparable to those without heel spurs.

CASE ILLUSTRATIONS

CASE 1

Site of maximum tenderness

Autologous blood injection

CASE 2

Site of maximum tenderness

Autologous blood injection

CASE 3

Site of maximum tenderness

Steroid injection

CASE 4

Site of maximum tenderness

Steroid injection

FOLLOWUP (3 months)

Patient pointing his visual analog score

Site of injection checked for tenderness/local complications

X-ray Ankles of patients showing heel spur at the classical site

.PROFORMA

NAME: **S.NO:**

AGE: **OP.NO:**

SEX:

OCCUPATION: **PHONE NO:**

PAIN DURATION:

SIDE: L/R

DRUG: B/S

HEEL SPUR: +/-

Pre- injection(0 wks)		Post- injection(2 wks)		Post-injection(4 wks)		Post - injection(12 wks)		Final Outcome
VAS	Nirschl	VAS	Nirschl	VAS	Nirschl	VAS	Nirschl	

FINAL OUTCOME: Poor/Acceptable/Good/Excellent

MASTER CHART

S.no	OP NO/ortho op.no	Age (yrs)	Sex M/F	Side L/R	Duration (mths)	Drug B/S	Pre-injection(0 wks)		Post-injection(2 wks)		Post-injection(4wks)		Post-injection(12wks)		Heel spur +/-	Outcome
							VAS	Nirschl	VAS	Nirschl	VAS	Nirschl	VAS	Nirschl		
1	220843/29497	40	F	L	1.5	B	5	6	3	3	4	3	4	3	_	A
2	221103/29571	42	F	L	5	B	6	6	5	5	5	4	5	4	+	A
3	221220/29529	46	M	R	2.5	B	7	5	5	4	5	4	4	3	_	A
4	230139/30786	30	F	L	6	S	7	7	5	5	5	5	5	5	_	A
5	221197/29532	36	F	R	1.5	B	8	7	4	3	5	4	5	4	+	A
6	229920/30708	35	F	L	1.5	S	6	6	3	3	5	4	5	4	_	A
7	200712/30798	64	M	L	1.5	B	5	6	3	3	4	3	4	3	+	A
8	231465/30907	55	F	L	1.5	S	6	7	0	0	0	0	0	0	+	E
9	228337/30511	60	M	L	3	S	5	6	0	0	1	2	3	3	_	A
10	215665/28810	27	F	L	24	B	8	4	8	4	8	4	9	5	_	A
11	130542/20899	40	M	L	3	S	6	6	2	2	2	1	2	2	_	G
12	665167	69	M	L	12	B	5	5	3	4	4	4	4	4	_	A
13	234180/3132	42	F	L	24	S	5	4	2	1	2	1	2	2	_	G

	6																
14	224976/30074	26	F	R	3	B	5	5	4	3	3	3	4	3	+	A
15	224999/30085	35	M	R	4	B	6	5	4	4	4	4	LF	LF	+	_
16	147768/34249	34	F	L	2	S	6	5	3	3	3	3	3	3	+	G
17	224799/30046	38	F	R	3	B	9	6	8	6	9	6	2	1	_	G
18	234310/31361	50	F	L	2	S	6	5	1	1	1	0	1	1	+	G
19	234783/31380	40	F	R	2	S	5	6	3	4	3	4	3	3	_	A
20	204110/27095	45	F	R	4	B	6	6	5	4	6	5	LF	LF	+	_
21	234888/31398	35	F	L	2	S	5	5	2	2	2	2	0	0	+	E
22	204186/27145	55	F	L	1.5	B	6	4	3	2	4	2	4	3	_	A
23	131794/18355	33	F	L	3	S	6	5	1	1	0	0	1	1	_	G
24	60885	50	M	L	1.5	B	7	5	4	3	3	3	3	3	_	A
25	199213/25587	57	F	L	5	B	7	6	5	4	6	5	LF	LF	+	_
26	235156/31427	23	F	R	2	S	6	6	1	1	1	1	1	1	+	G
27	199611/26562	52	M	R	1.5	B	5	4	4	3	4	3	4	4	+	A
28	236501/31605	32	F	L	3	S	5	5	0	0	0	0	5	5	_	A
29	239091/31973	45	F	L	1.5	S	7	5	3	3	2	2	3	3	+	A
30	226541/29880	37	F	L	2	B	6	6	4	3	5	4	5	4	_	A
31	623113/31993	30	F	L	48	S	8	6	2	2	3	2	8	6	+	P
32	19853	60	M	R	3	S	5	5	2	2	3	2	3	2	+	G

	5/26381															
33	226680/30328	35	F	L	24	B	7	5	3	2	4	2	3	2	_	G
34	219531/29296	40	F	R	3	S	6	5	5	4	6	5	6	5	+	A
35	231263/31336	36	F	L	10	S	6	6	3	2	3	3	LF	LF	+	_
36	231623/31689	36	F	L	1.5	S	6	5	3	2	3	3	4	3	_	A
37	231829/31769	55	M	L	2	S	7	6	3	4	3	3	4	3	+	A
38	393350/55745	67	M	L	24	B	5	5	2	3	3	3	4	3	+	A
39	227054/30370	38	F	R	1.5	B	7	5	7	5	7	5	7	5	+	A
40	227242/30372	39	F	L	6	B	7	5	6	5	6	6	6	5	+	A
41	221628/29936	60	F	L	3.5	S	5	4	3	3	2	2	LF	LF	_	_
42	229332/30616	40	F	R	5	B	6	7	6	7	6	7	2	2	_	G
43	242869/32581	42	M	R	3	S	5	5	2	3	2	2	3	3	+	A
44	229997/30714	50	F	L	3	B	6	5	1	1	3	3	6	5	+	A
45	229979/30715	50	F	R	24	B	5	6	1	2	2	3	2	2	_	G
46	230177/30738	30	F	L	12	B	7	6	1	1	1	1	3	3	_	A
47	230282/30769	60	F	L	1.5	B	6	5	2	2	3	2	3	3	+	A
48	231889/31996	38	M	L	2	S	6	4	3	2	3	3	LF	LF	+	_
49	231489/31496	40	F	L	4	S	7	4	3	2	3	3	LF	LF	_	_
50	230086/31283	42	F	L	2	S	7	4	3	2	2	2	4	2	+	G

KEY:

L-left R-right M-male F-female B-blood S-steroid VAS-visual analog scale +: present

P-poor G-good A-acceptable E-excellent - : absent

LF-lost follow-up

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